

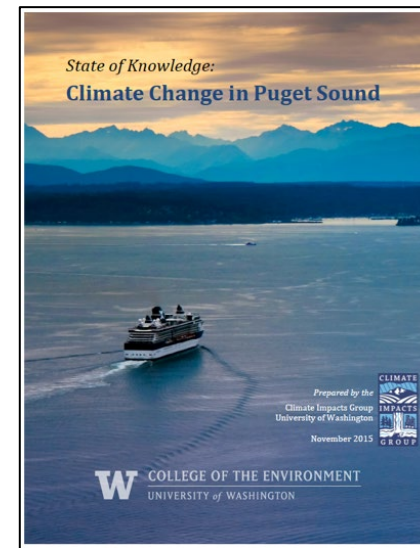
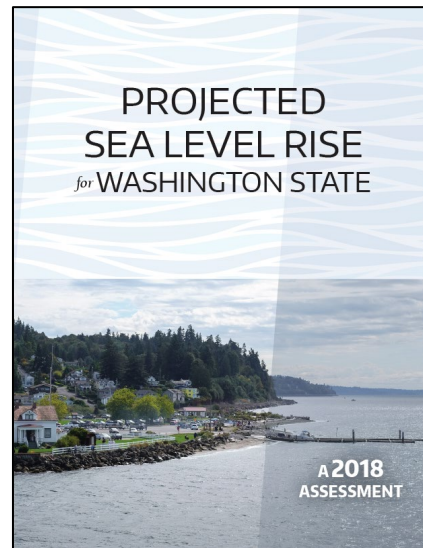
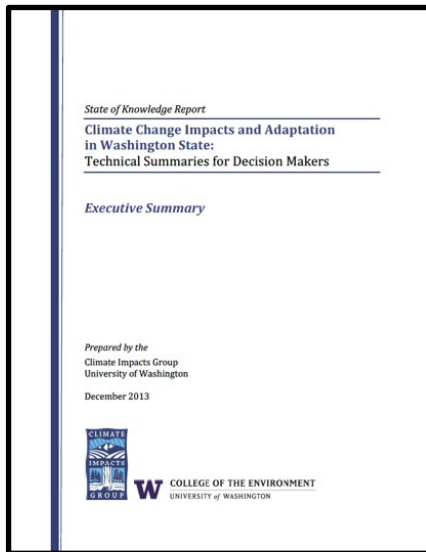
Climate Change Impacts on Streamflow and Water Supply



Guillaume Mauger

Climate Impacts Group
University of Washington

Climate change reports for Washington



<https://cig.uw.edu/resources/special-reports/>

Climate Matters: Washington's economy, infrastructure and natural systems were built to succeed in the context of the climate of the past.

2015: A preview of the future



Warmest year on record for the NW
~5°F warmer than pre-industrial



7th driest January to June in the Northwest



Lowest snowpack on record for WA
30% of normal (1970-1999 average)

2015:

FISHERIES

Low summer streamflow & warm waters resulted in fishery closures



>250,000

**Columbia
River sockeye
salmon died**

RECREATION

Low snowpack led to reductions in winter & summer recreation



42%

**shorter ski
season at
Stevens Pass**

WILDFIRE

The most severe wildfire season in Washington's recorded history



>1,000,000

**acres
burned**

**>\$253
million**

**fire
suppression**

AGRICULTURE

Warm temperatures & reduced water availability stressed WA agriculture



17

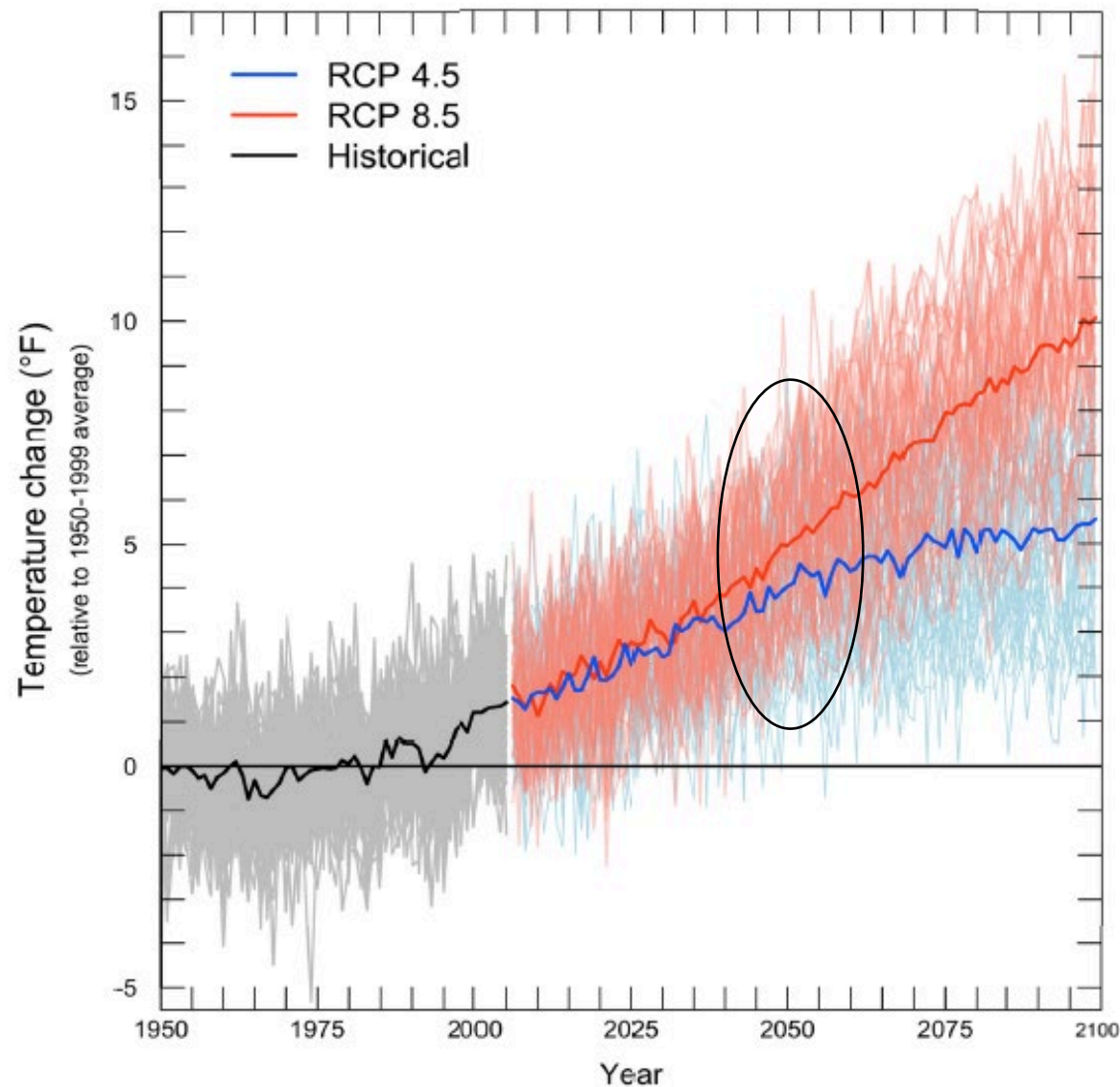
**major crops
with reduced
yields**

**\$633-733
million**

**economic
losses**

Projected changes are much larger than what we've seen so far: This will worsen existing impacts and bring on new ones that haven't been detected in the past.

Rapid Warming for the Northwest



In the 2050s, Washington state is projected to see warming of

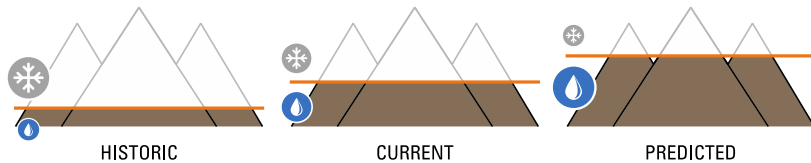
+5.8°F **High emissions**
(3.1-8.5°F) (RCP 8.5)

+4.3°F **Low emissions**
(2.0-6.7°F) (RCP 4.5)

(Relative to 1950-1999)

Snow

Our primary mechanism for storing water – snow – is sensitive to warming.

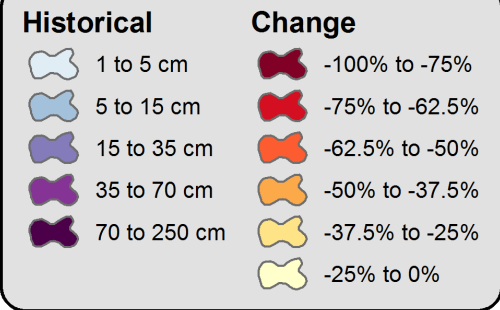
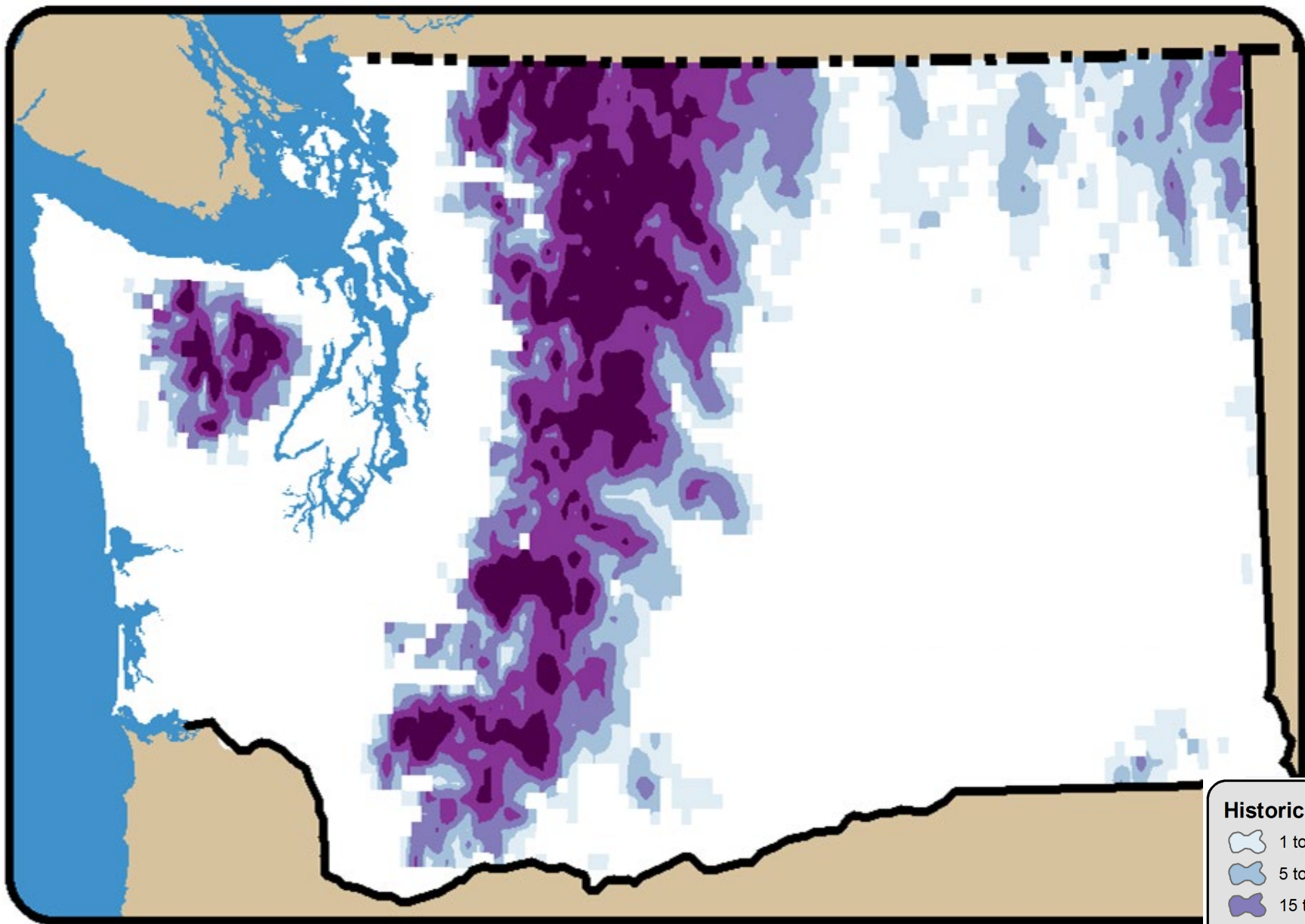




Declining snowpack is the major driver;
other factors exacerbate impacts

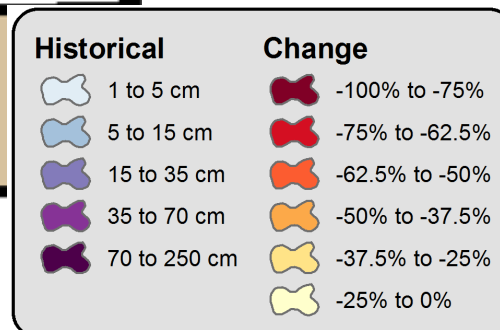
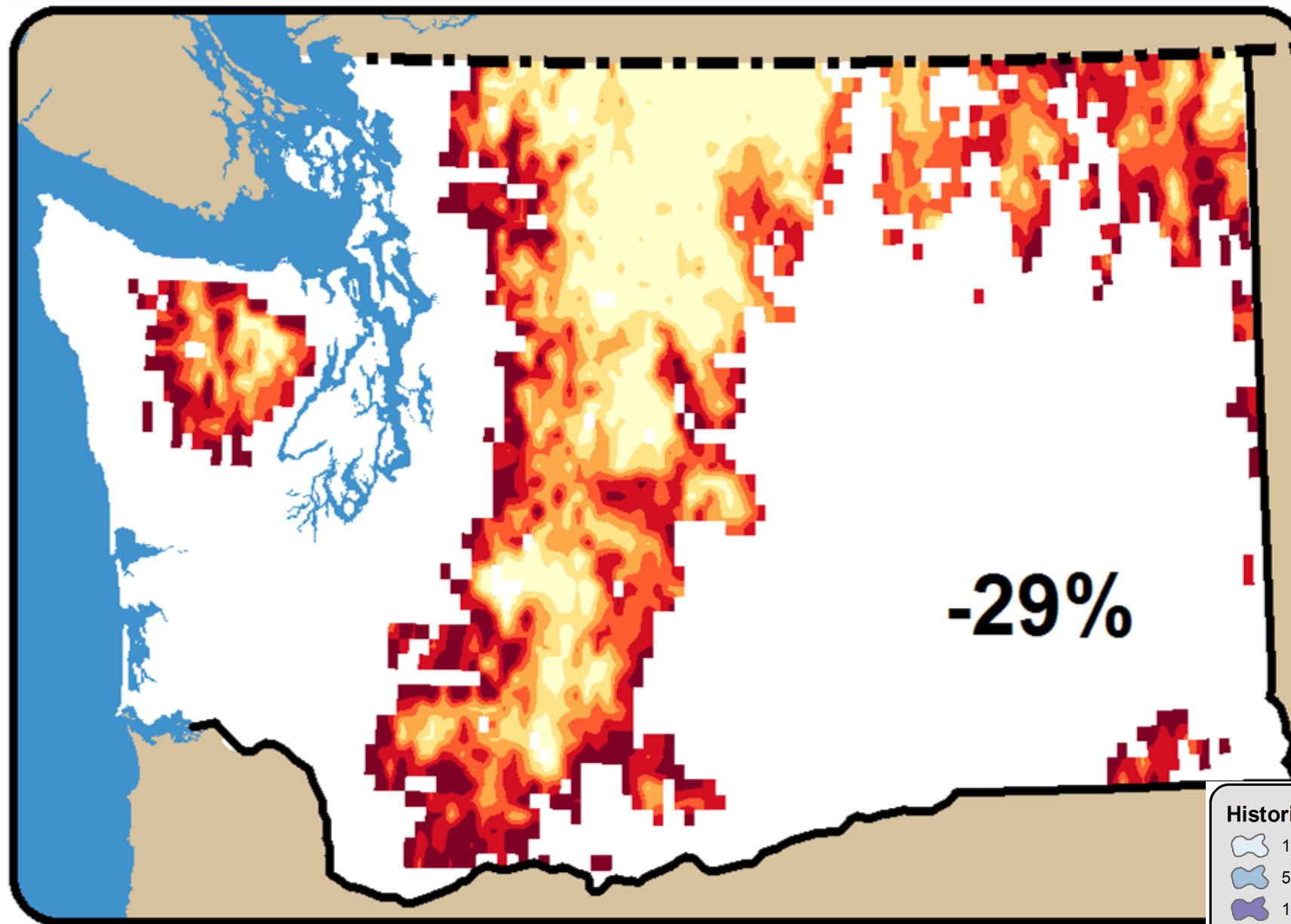
- Receding glaciers
- Wildfire
- Decreases in summer precipitation

Historical (1970-1999)



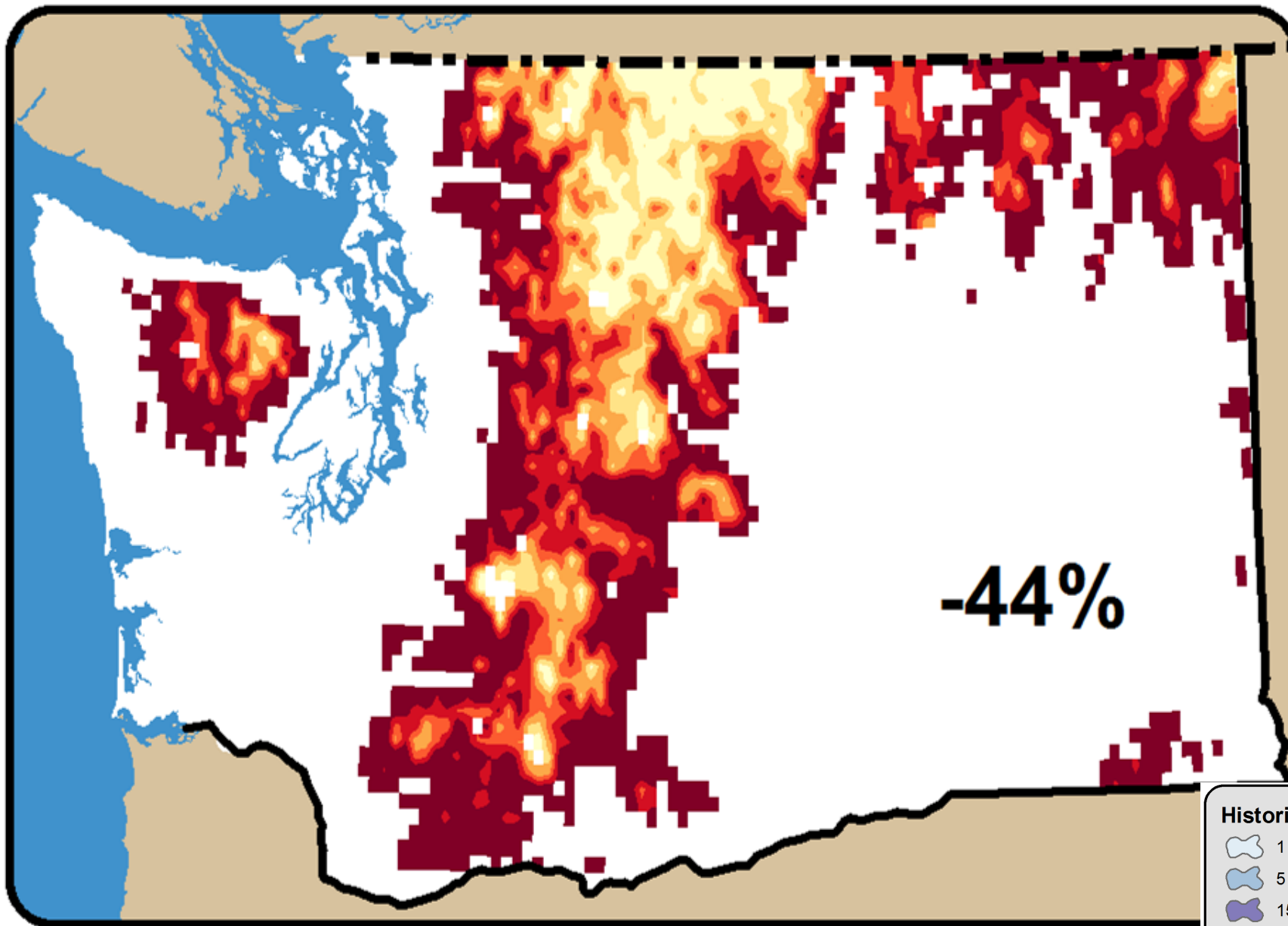
April 1 Snow Water Equivalent

2020s

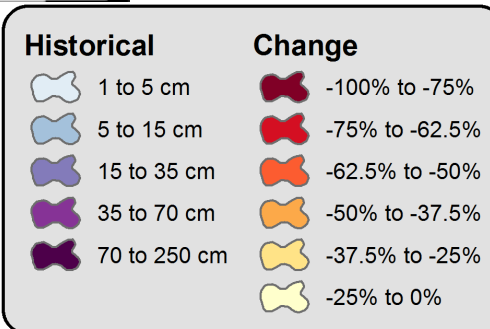


April 1 Snow Water Equivalent

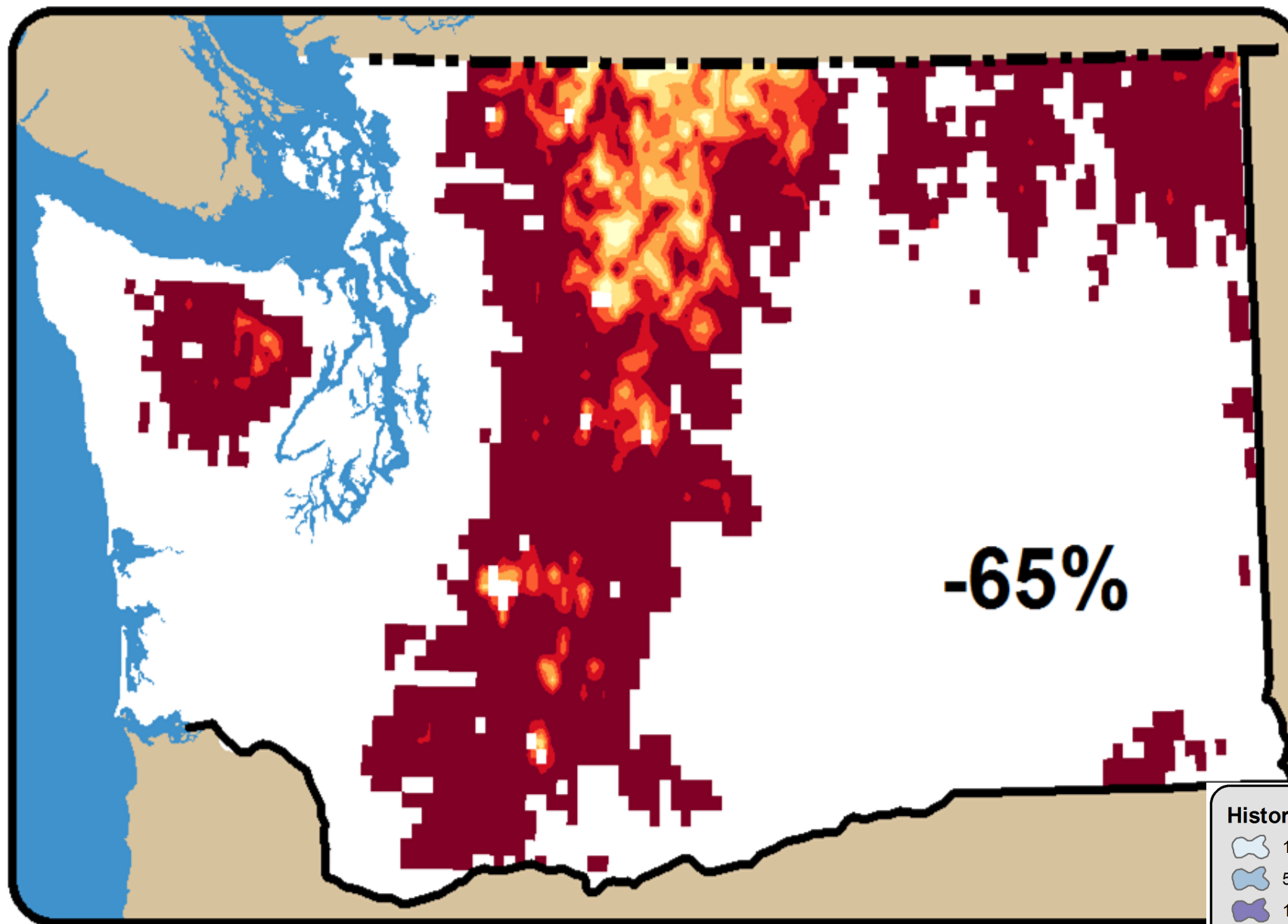
2040s



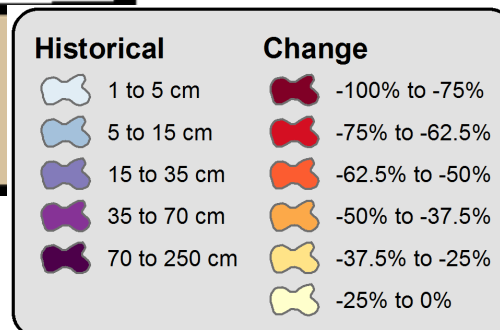
April 1 Snow Water Equivalent



2080s



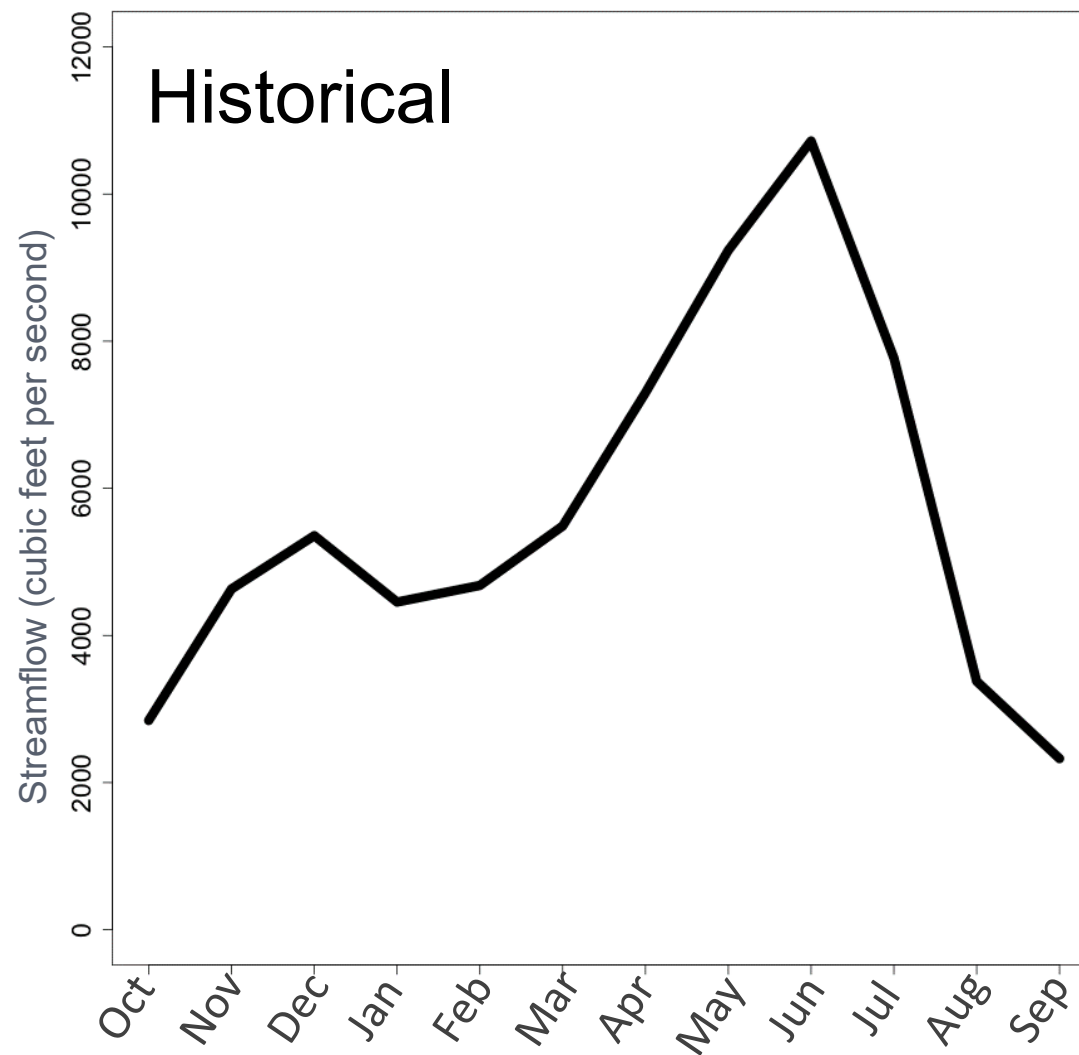
-65%



April 1 Snow Water Equivalent

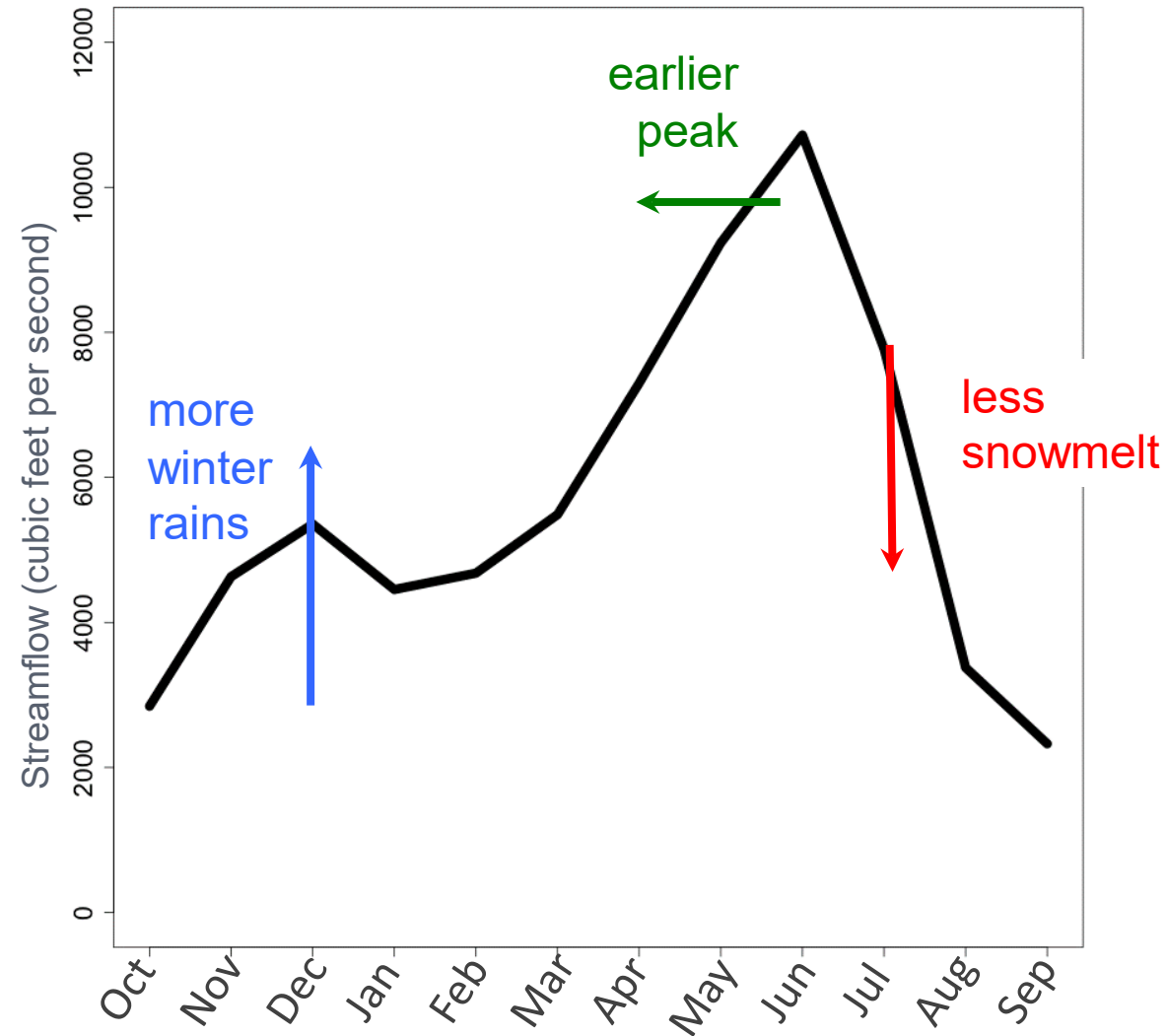


Mid-elevation WA rivers flow when it rains and when snow melts



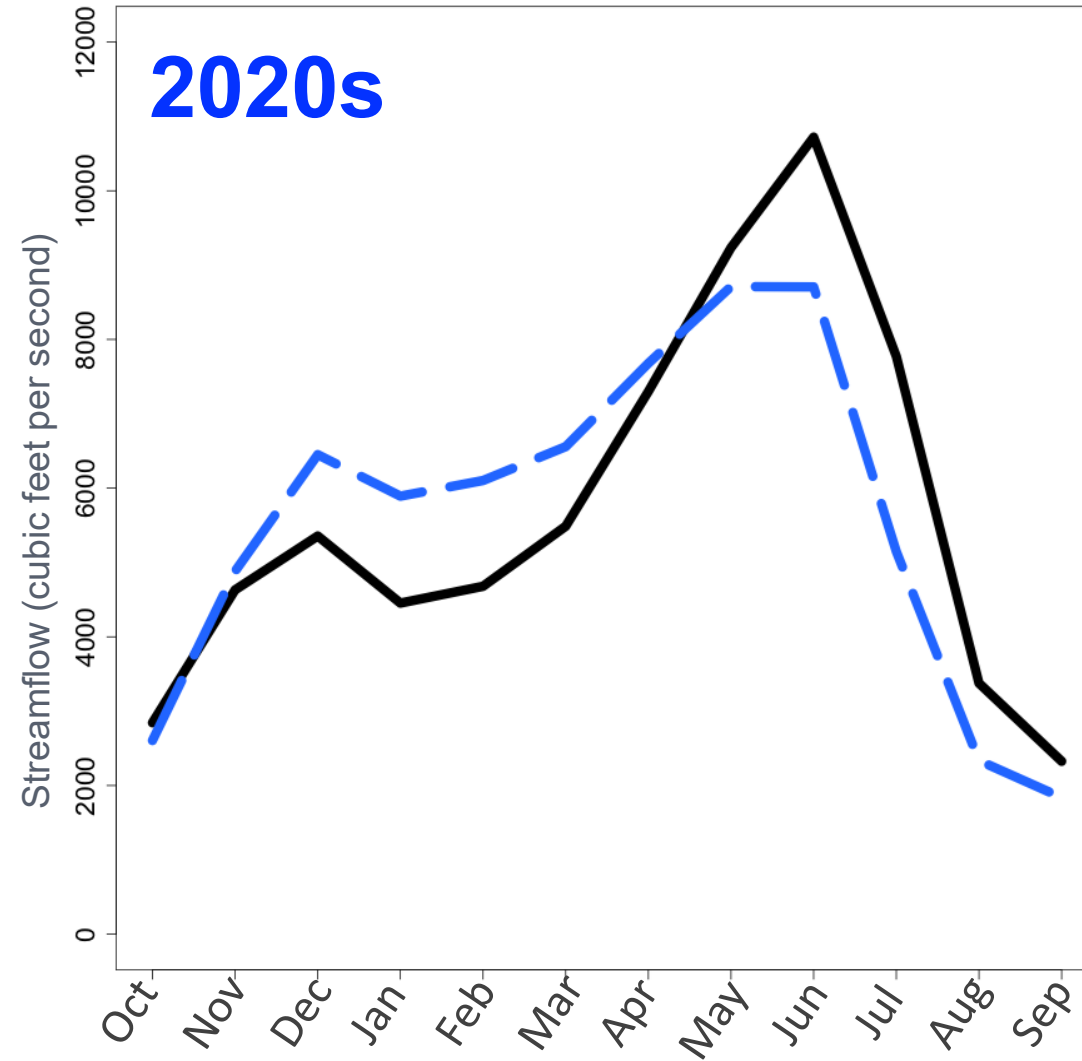
Naturalized flows in the Yakima basin, Washington (without the influence of dams); Elsner et al. 2010

Warming shifts streamflows



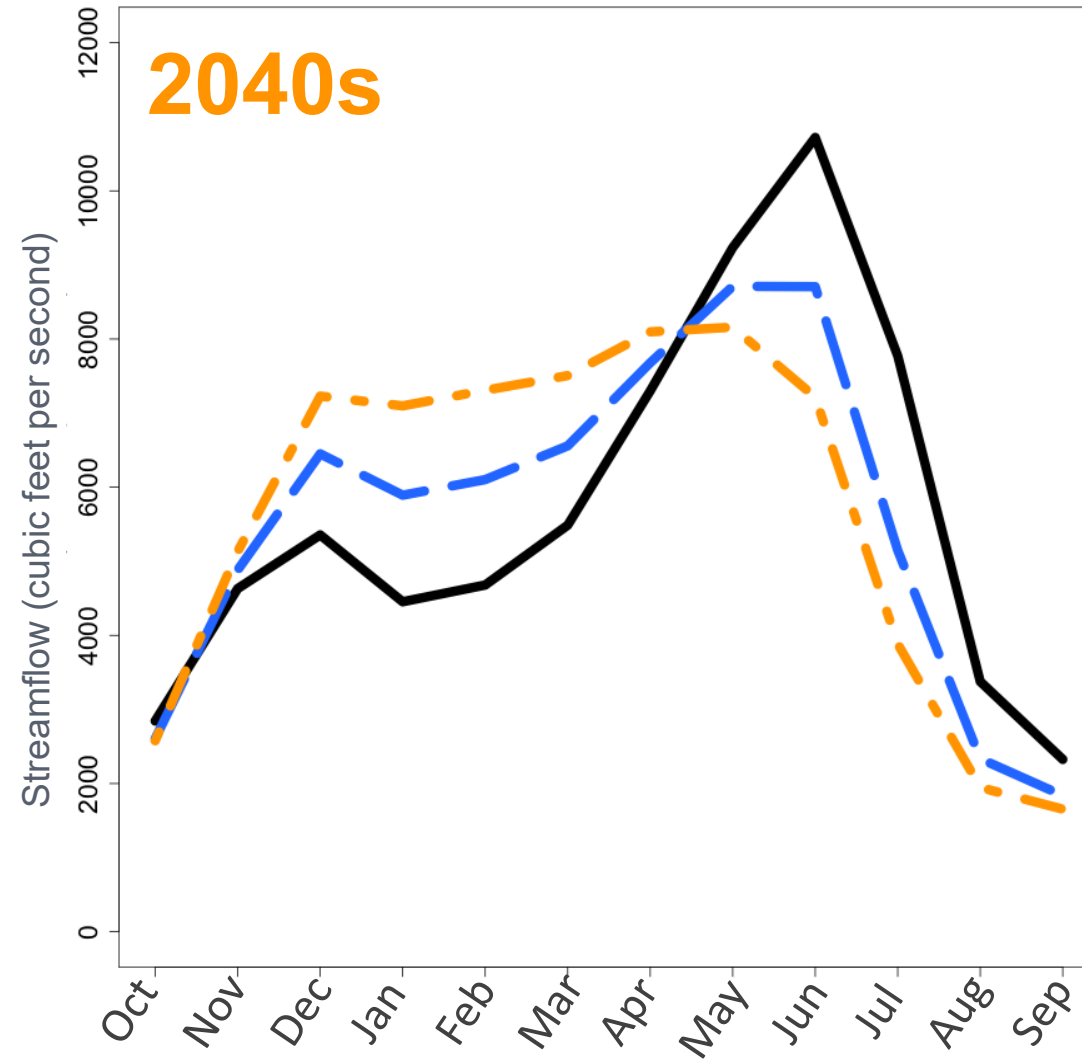
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Warming shifts streamflows



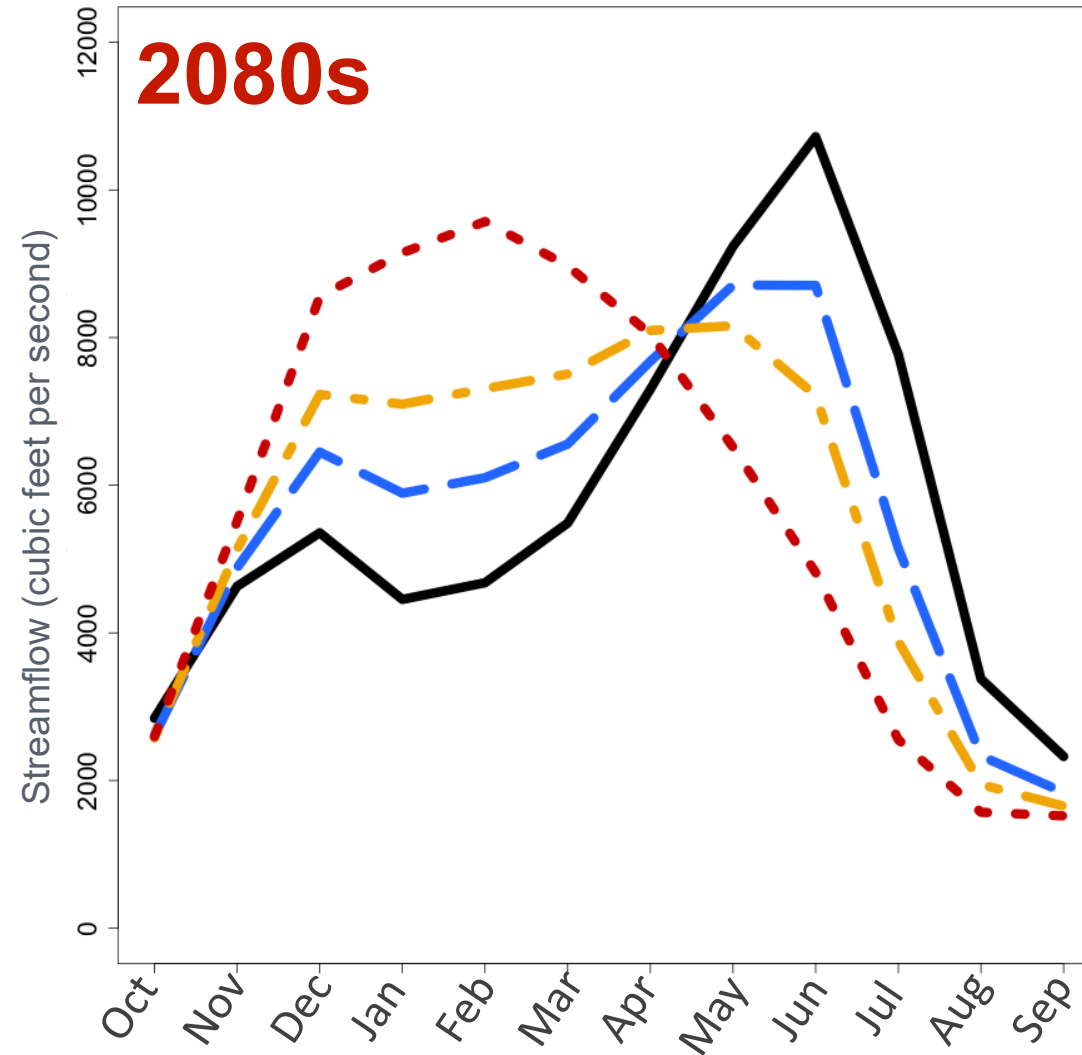
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Warming shifts streamflows

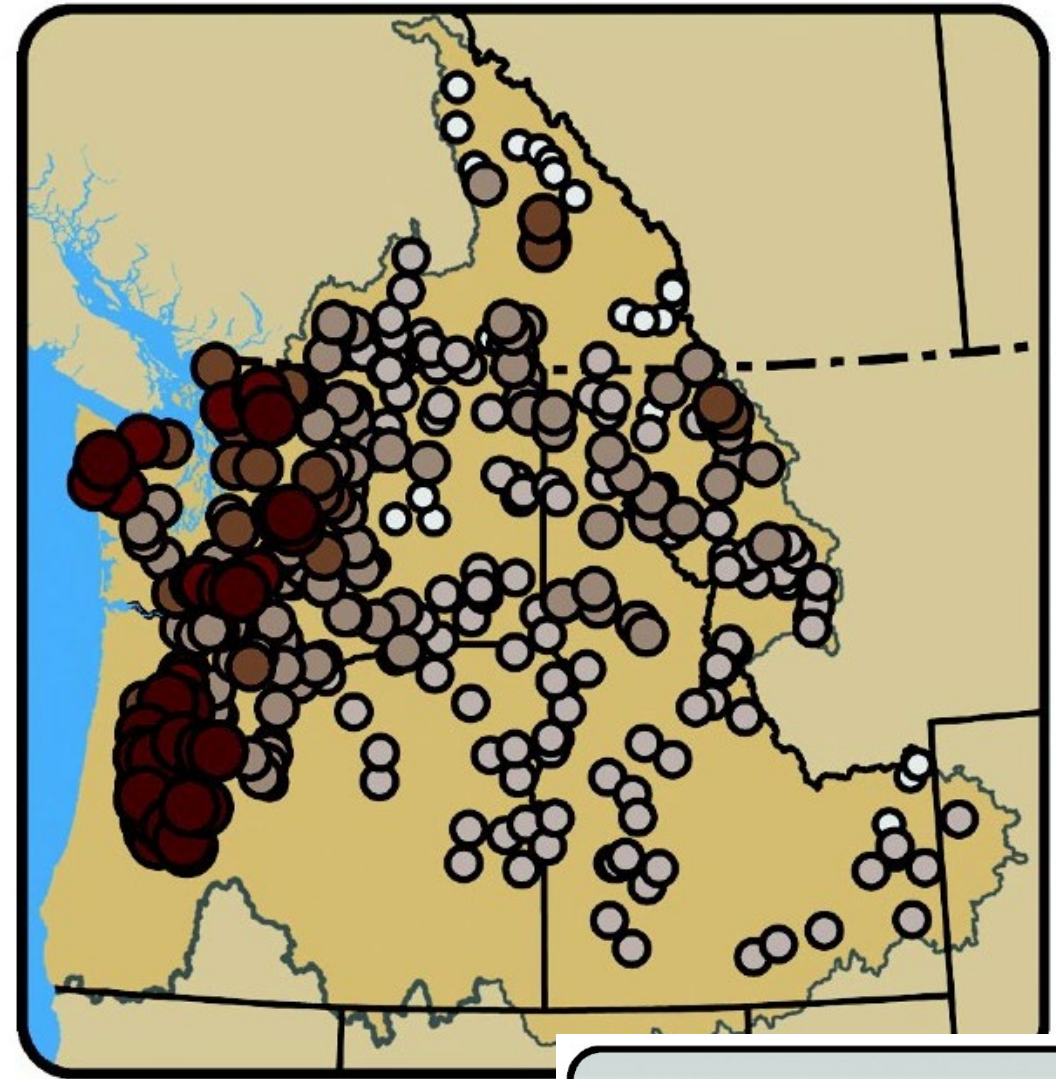


Similar changes expected for the many NW rivers at mid-elevation

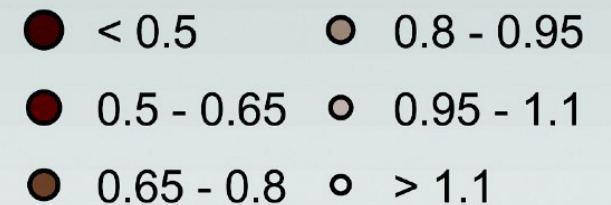
Largest changes in low flows projected West of the Cascades

West of the Cascades: evaporation is currently energy limited; warming packs more of a punch

East of the Cascades, evaporation is water limited

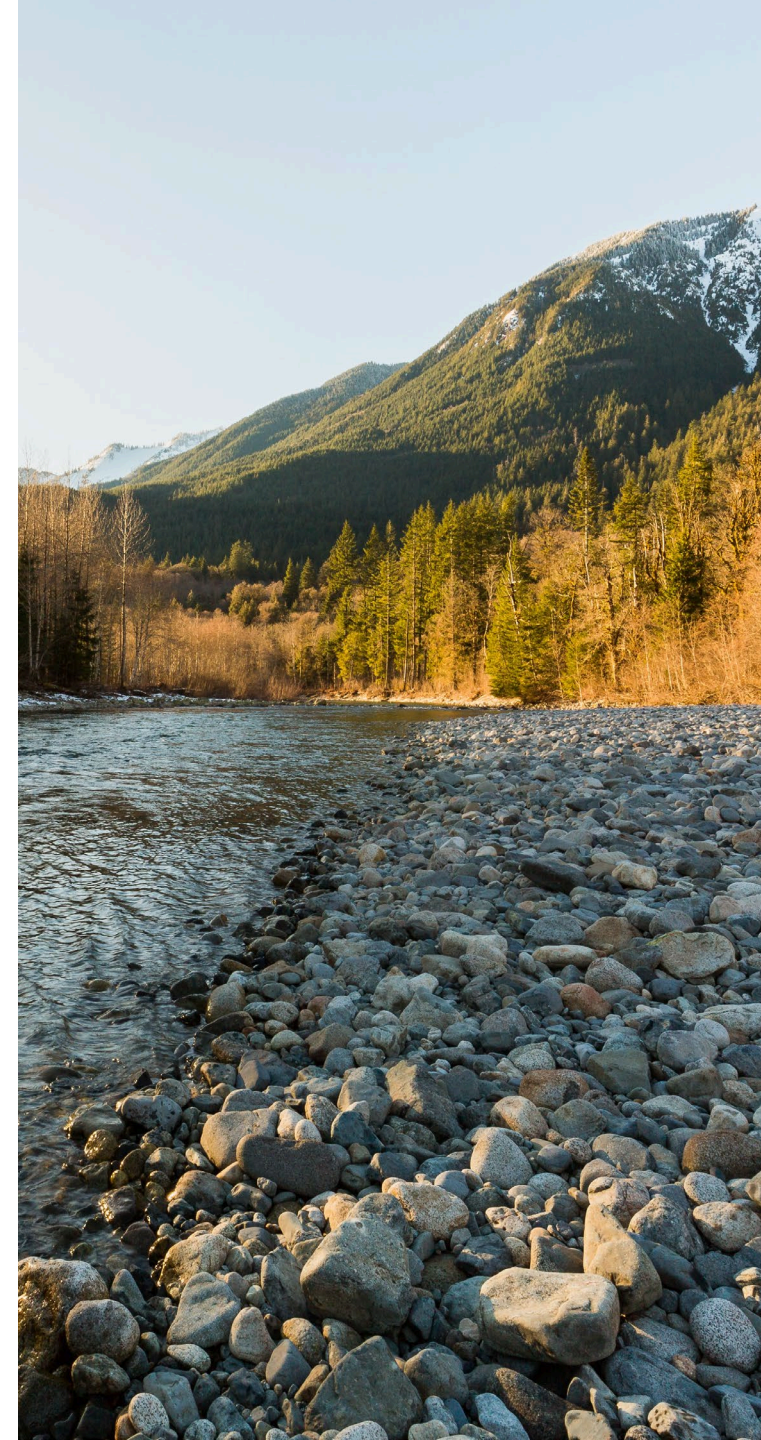


Change in 7-Day
Minimum Flows,
2080s



Impacts depend on magnitude of changes *and* management flexibility

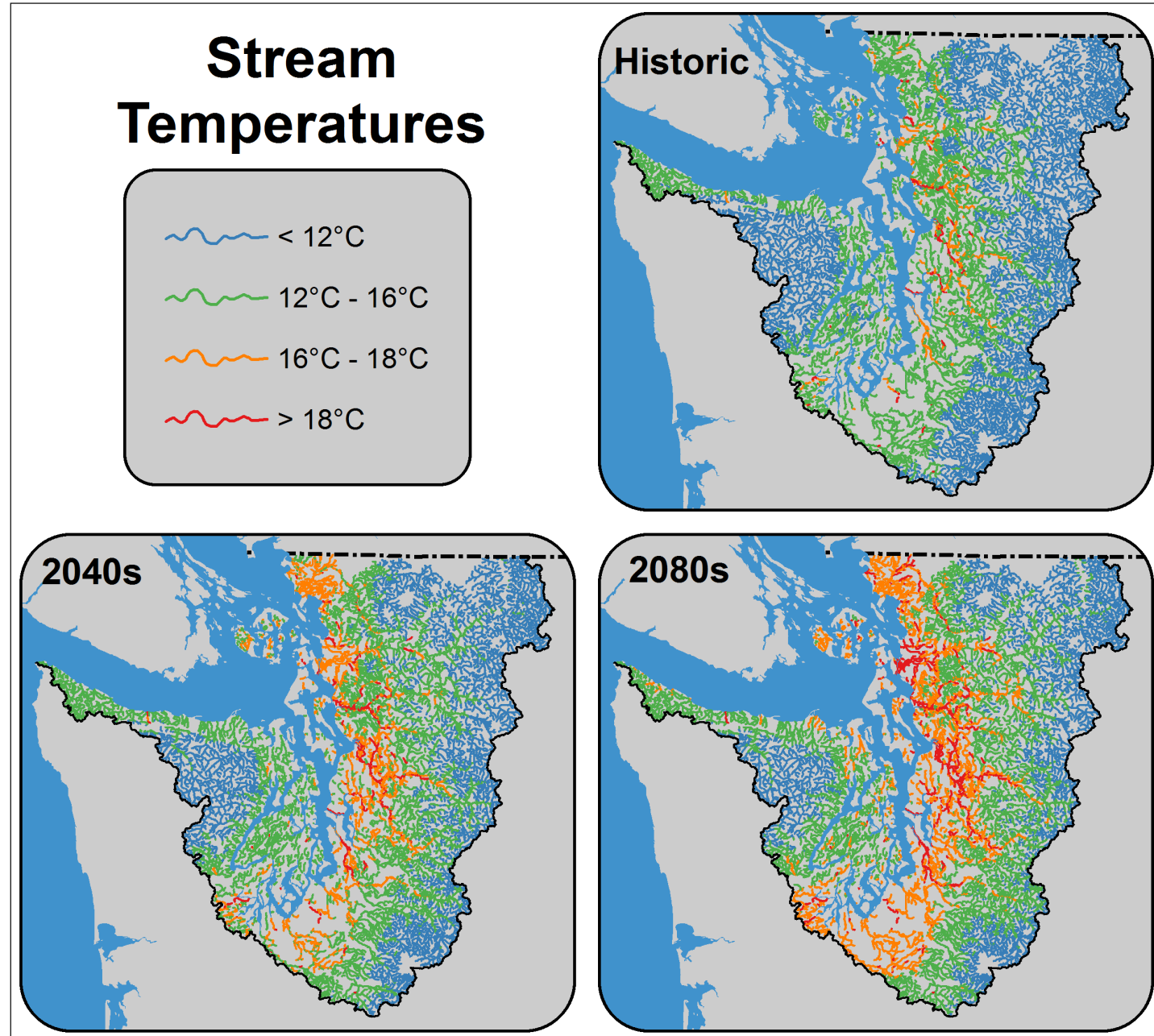
- *Yakima*: Water curtailments for junior users increase from 14% to 68% of years, by the 2080s. (*Vano et al. 2010a*)
- *Statewide*: Increased summer hydropower demand due to A/C use and population growth. (*Hamlet et al. 2010*)
- *Everett, Tacoma*: Water supply reliability remains high even with changes in demand (*Vano et al. 2010b*)
- *Seattle*: High water supply reliability except for demand increases > ~25% (*Vano et al. 2010b*)



Less Water = Warmer Water

By the 2080s, in Puget Sound:

- Stream temperatures, on average, are projected to increase by +4.0°F to +4.5°F by the 2080s.
- Number of river miles exceeding thermal tolerances are projected to increase by >1,000 mi. for salmon, and >2,800 mi. for char



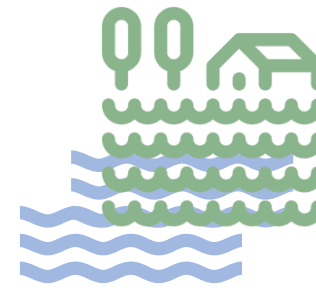
Acting now will reduce harm in the future

The extent of harm from global warming depends on...

How much warming occurs



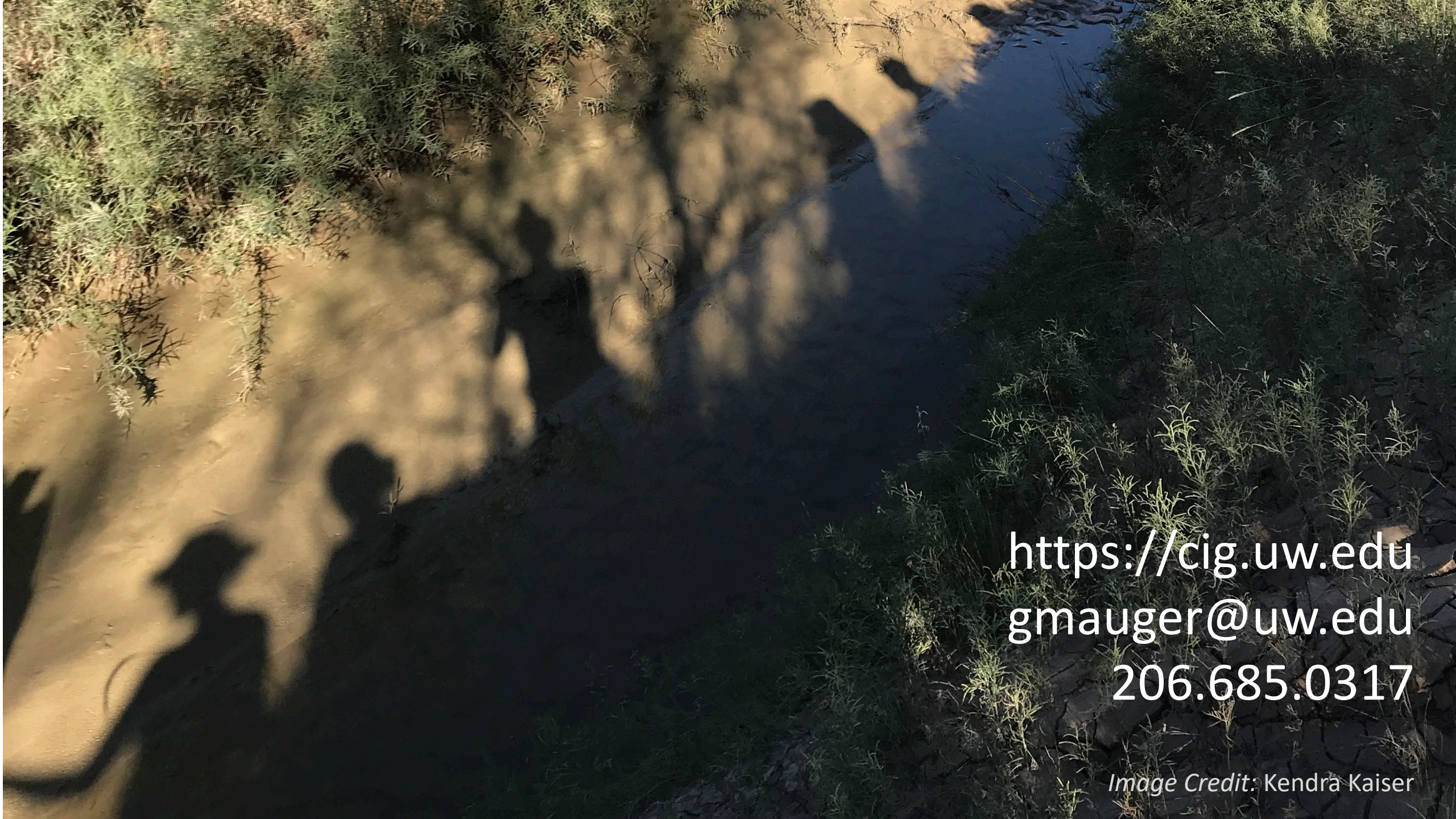
Local resilience to warming's impacts



Today's actions shape tomorrow's risks through...

Choices about energy use,
fuel type ... fossil fuel
emissions

Deciding whether to plan & manage our
communities, economy & ecosystems for
the climate of the future or the climate of
the past



<https://cig.uw.edu>
gmauger@uw.edu
206.685.0317

Image Credit: Kendra Kaiser